

California Pest Rating Proposal for

Kuehneola uredinis (Link) Arthur 1906

Rubus cane and leaf rust

Current Pest Rating: Z

Proposed Pest Rating: C

Kingdom: Fungi, Phylum: Basidiomycota,
Class: Pucciniomycotina, Subclass: Pucciniomycetes
Order: Pucciniales, Family: Phragmidiaceae

Comment Period: **09/03/2021 through 10/18/2021**

Initiating Event:

The USDA's Federal Interagency Committee on Invasive Terrestrial Animals and Pathogens (ITAP.gov) Subcommittee on Plant Pathogens has identified the worst plant pathogens that are either in the United States and have potential for further spread or represent a new threat if introduced. *Kuehneola uredinis*, cane and leaf rust of blackberries, is on their list. This pathogen has been in California for several decades and has been assigned a temporary Z rating. A pest risk assessment of this fungus is presented here, and a permanent pest rating for California is proposed.

History & Status:

Background: *Kuehneola uredinis* is a fungal pathogen that causes cane and leaf rust in *Rubus* spp., including blackberries, boysenberries, olallieberries and marionberries, plus wild and ornamental species; red and black raspberries are rarely infected. Under favorable climatic conditions, it can be highly destructive, causing canes to break and causing severe defoliation, especially on highly susceptible hybrid cultivars (Ellis et al., 1991).

It is an autoecious, brachycyclic rust. *Rubus* is the only host and it has four spore stages. It lacks basidiospores, but produces telial, spermagonial, aecial, and uredinal states. There are other rust species that attack *Rubus*, but cane and leaf rust can be recognized by the lemon-yellow pustules on both types of canes (primocanes and floricanes) and leaves.

Hosts: *Rubus abbrevians*, *R. adolfi-friedericii*, *R. allegheniensis*, *R. apetalus*, *R. argutus*, *R. betulifolius*, *R. bifrons*, *R. caesius*, *R. canadensis*, *R. candicans*, *R. canescens*, *R. constrictus*, *R. cuneifolius*, *R. flagellaris*,

R. frondosus, *R. fruticosus*, *R. glandicaulis*, *R. glandulosus*, *R. gracilis*, *R. hawaiiensis*, *R. hirtus*, *R. hispidus*, *Rubus* hybrid, *R. idaeus*, *R. idaeus* var. *aculeatissimus*, *R. inermis*, *R. laciniatus*, *R. lindebergii*, *R. loganobaccus*, *R. macraei*, *R. macropetalus*, *R. macrophyllus*, *R. jeckylanus*, *R. loganobaccus*, *R. multiformis*, *R. nemorosus*, *R. nigrobaccus*, *R. palmatus*, *R. penetrans*, *R. pergratus*, *R. plicatus*, *R. poliophyllus*, *R. procumbens*, *R. pubescens*, *R. rigidus*, *R. rossbergianus*, *R. schleicheri*, *R. schmidelioides*, *R. selmerii*, *R. setosus*, *Rubus* sp., *R. transvaliensis*, *R. triflorus*, *R. trivialis*, *R. ulmifolius*, *R. ursinus*, *R. ursinus* var. *loganobaccus*, *R. villosus*, *R. villicaulis*, and *R. vitifolius*.

Symptoms: The first symptom in late spring is lemon yellow pustules (uredinia) that erupt from under the bark of the fruiting canes (floricanes) of susceptible *Rubus* spp. Canes become brittle and easily break. Urediniospores from the floricanes infect the leaves and produce smaller yellow uredinia on the undersides of leaves during early summer. Defoliation can occur if infection is severe, especially if there are multiple secondary cycles of urediniospores produced. Buff-colored telia develop among the uredinia on leaves in early fall. These produce teliospores which infect leaves on new season's primocanes, which develop pustules containing spermogonia and aecia. Pustules may also be seen on fruit.

The symptoms can be confused with orange rust, caused by *Gymnoconia nitens* (syn. *Arthuriomyces peckianus*). Orange rust is systemic, growing into plant crowns and roots. It weakens plants severely, and systemically infected plants produce few or no blossoms. Cane and leaf rust can be distinguished from orange rust by the presence of yellow pustules (uredinia) on both the canes and leaves. Orange rust has orange pustules on leaves only (Koike et al., 2009; Pscheidt and Ocamb, 2021).

Transmission: This fungal pathogen forms several spore types, which can infect stems of the floricanes and leaves and stems of primocanes. This rust is not systemic in the plant. Wet conditions favor disease development and spores are windborne. The fungus overwinters on canes as mycelium or latent uredinia. Long distance spread is with infected planting stock.

Damage Potential: Cane and leaf rust can cause severe damage on some susceptible blackberry and hybrid *Rubus* species but little or no infection on resistant species (Gardner and Hodges, 1983; Shands et al., 2018). *Kuehneola uredinis* predominantly affects American blackberry cultivars, blackberry-raspberry hybrid species, dewberry (a blackberry-like cultivar), *Rubus fruticosus* (European blackberry) and wild blackberry species. On susceptible varieties, leaf defoliation can be severe and result in the loss of plant vigor. Normally cane and leaf rust doesn't infect the fruit but masses of spores falling on fruit can render it unmarketable. Raspberries are hosts, but disease on this crop is rare. If infection is severe, premature defoliation can occur on floricanes and cane vigor is reduced making the plants more susceptible to winter low temperatures (Ellis et al., 1991). In Korea, Cheon et al. (2013) reported 90% of the leaves on European blackberry (*Rubus fruticosus*), were affected by rust pustules.

Worldwide Distribution: Afghanistan, Argentina, Australia, Azores, Belgium, Bermuda, Bulgaria, Canada, Germany, Guatemala, Jamaica, Japan, Korea, New Zealand, Norway, Poland, Romania, Southern Africa, Turkey, United Kingdom, United States (*California, Connecticut, Georgia, Hawaii, Idaho, Illinois, Indiana, Iowa, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi,*

Missouri, North Carolina, New Hampshire, New York, Oregon, Pennsylvania, Rhode Island, Vermont, Washington, Wisconsin) and Zimbabwe (Farr and Rossman, 2021; Karsli and Tezcan, 2020).

Official Control: *Kuehneola uredinis* is on the EPPO's A1 list for Chile (EPPO, 2021) and on the USDA's harmful organism list for Chile, India, and Peru (USDA PCIT, 2021).

California Distribution: There are official records from the following counties: Contra Costa, Mendocino, Monterey, Riverside, Sacramento, San Mateo, Santa Cruz, Santa Barbara, and Shasta. It was first reported in Los Angeles County (Santa Catalina Island) by Millspaugh, and Nuttall (1923).

California Interceptions: None.

The risk *Kuehneola uredinis* would pose to California is evaluated below.

Consequences of Introduction:

- 1) Climate/Host Interaction:** Rust fungi are obligate pathogens, requiring a living host. Although favored by wet weather, this pathogen is likely to occur wherever its hosts are grown.

Evaluate if the pest would have suitable hosts and climate to establish in California.

Score: 2

- Low (1) Not likely to establish in California; or likely to establish in very limited areas.
- **Medium (2) may be able to establish in a larger but limited part of California.**
- High (3) likely to establish a widespread distribution in California.

- 2) Known Pest Host Range:** The host range is limited to members of the genus *Rubus*.

Evaluate the host range of the pest.

Score: 1

- **Low (1) has a very limited host range.**
- Medium (2) has a moderate host range.
- High (3) has a wide host range.

- 3) Pest Reproductive Potential:** This is an autoecious rust, with only one host. It produces multiple spore types that can autoinfect. Spores are windblown or transported with infected planting material.

Evaluate the natural and artificial dispersal potential of the pest.

Score: 2

- Low (1) does not have high reproductive or dispersal potential.
 - **Medium (2) has either high reproductive or dispersal potential.**
 - High (3) has both high reproduction and dispersal potential.
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- 4) Economic Impact:** The impact of this disease depends on the susceptibility of the host. Susceptible species and varieties can become heavily infected, with severe defoliation, cane breakage, loss of vigor, loss of fruit yield, and increased risks of winter injury.

Evaluate the economic impact of the pest to California using the criteria below.

Economic Impact: A, C

A. The pest could lower crop yield.

B. The pest could lower crop value (includes increasing crop production costs).

C. The pest could trigger the loss of markets (includes quarantines).

D. The pest could negatively change normal cultural practices.

E. The pest can vector, or is vectored, by another pestiferous organism.

F. The organism is injurious or poisonous to agriculturally important animals.

G. The organism can interfere with the delivery or supply of water for agricultural uses.

Economic Impact Score: 2

- Low (1) causes 0 or 1 of these impacts.

- **Medium (2) causes 2 of these impacts.**

- High (3) causes 3 or more of these impacts.

- 5) Environmental Impact:** There are 18 species of *Rubus* listed by CalFlora. Some are invasive non-natives such as the Himalayan blackberry, *Rubus armeniacus*, while other are rare natives. The native California blackberry, *Rubus ursinus*, can be severely affected by this rust in Monterey County (Shands et al., 2018). Susceptible varieties require pre-infection fungicide treatments to protect them in the spring.

Evaluate the environmental impact of the pest to California using the criteria below

Environmental Impact: A, D, E

A. The pest could have a significant environmental impact such as lowering biodiversity, disrupting natural communities, or changing ecosystem processes.

B. The pest could directly affect threatened or endangered species.

C. The pest could impact threatened or endangered species by disrupting critical habitats.

D. The pest could trigger additional official or private treatment programs.

E. The pest significantly impacts cultural practices, home/urban gardening or ornamental plantings.

Environmental Impact Score: 3

- Low (1) causes none of the above to occur.

- Medium (2) causes one of the above to occur.

- **High (3) causes two or more of the above to occur.**

Consequences of Introduction to California for *Kuehneola uredinis*: Medium

Add up the total score and include it here. 10

-Low = 5-8 points

-Medium = 9-12 points

-High = 13-15 points

- 6) Post Entry Distribution and Survey Information:** Evaluate the known distribution in California. Only official records identified by a taxonomic expert and supported by voucher specimens deposited in natural history collections should be considered. Pest incursions that have been eradicated, are under eradication, or have been delimited with no further detections should not be included.

There are records of this pathogen in California going back almost a century. There are official records from multiple counties in Northern California, along the coast, and from Southern California (French, 1989: CDFA PDR Database).

Evaluation is 'high'.

Score: -3

-Not established (0) Pest never detected in California or known only from incursions.

-Low (-1) Pest has a localized distribution in California or is established in one suitable climate/host area (region).

-Medium (-2) Pest is widespread in California but not fully established in the endangered area, or pest established in two contiguous suitable climate/host areas.

-High (-3) Pest has fully established in the endangered area, or pest is reported in more than two contiguous or non-contiguous suitable climate/host areas.

- 7) The final score is** the consequences of introduction score minus the post entry distribution and survey information score: (Score)

Final Score: Score of Consequences of Introduction – Score of Post Entry Distribution and Survey Information = 7

Uncertainty:

California has a large and growing caneberry industry. As new varieties are developed, their susceptibility to rust will be challenged in the fields with inoculum from wild or naturalized *Rubus* spp.

Conclusion and Rating Justification:

Based on the evidence provided above the proposed rating for *Kuehneola uredinis* is C.

References:

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Responsible Party:

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***Comment Period: 09/03/2021 through 10/18/2021**

***NOTE:**

You must be registered and logged in to post a comment. If you have registered and have not received the registration confirmation, please contact us at [permits\[@\]cdfa.ca.gov](mailto:permits[@]cdfa.ca.gov).

Comment Format:

- ❖ Comments should refer to the appropriate California Pest Rating Proposal Form subsection(s) being commented on, as shown below.

Example Comment:

Consequences of Introduction: 1. Climate/Host Interaction: [Your comment that relates to “Climate/Host Interaction” here.]

- ❖ Posted comments will not be able to be viewed immediately.
 - ❖ Comments may not be posted if they:
 - Contain inappropriate language which is not germane to the pest rating proposal;
 - Contains defamatory, false, inaccurate, abusive, obscene, pornographic, sexually oriented, threatening, racially offensive, discriminatory or illegal material;
 - Violates agency regulations prohibiting sexual harassment or other forms of discrimination;
 - Violates agency regulations prohibiting workplace violence, including threats.
 - ❖ Comments may be edited prior to posting to ensure they are entirely germane.
 - ❖ Posted comments shall be those which have been approved in content and posted to the website to be viewed, not just submitted.
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Proposed Pest Rating: C
